

| INTERNATIONAL APPLICATION PUBLISH | HED I | JNDER THE PATENT COOPERATION TREATY (PCT) |
|--|-----------|--|
| (51) International Patent Classification ⁶ : | | (11) International Publication Number: WO 99/35113 |
| C07C 29/149, C07D 307/08, 307/32 | A3 | (43) International Publication Date: 15 July 1999 (15.07.99) |
| (21) International Application Number: PCT/EP (22) International Filing Date: 5 January 1999 (| | BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GD, |
| (30) Priority Data: 9800012 8 January 1998 (08.01.98) (71) Applicant (for all designated States except US): EU | RODIO | SI, SK, SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent |
| S.A. [BE/BE]; Parc Industriel Zone A, B-7181 Fe | eluy (B | SN, TD, TG). |
| (75) Inventor; and (75) Inventor/Applicant (for US only): BERTOLA, Ald Via Luigi Illica, 5, I-20121 Milano (IT). | o [IT/I' | [7]; Published With international search report. |
| (74) Agent: SARPI, Maurizio; Studio Ferrario, Via Co I-00187 Roma (IT). | ollina, i | (88) Date of publication of the international search report: 16 September 1999 (16.09.99) |
| | | |
| | | |
| | | |
| | | |
| (54) Title: A PROCESS FOR THE PRODUCTION OF | TETRA | AHYDROFURAN, GAMMABUTYROLACTONE AND BUTANEDIOL |
| (57) Abstract | | valences and butonedial starting from maleic anhydride esters. consisting |
| Process for the production of tetrahydrofuran, game of two subsequent hydrogenations. | mabuty | rolactone and butanediol starting from maleic anhydride esters, consisting |
| | | • |
| | | |
| · | | |
| | | |
| | | |
| | | |
| | | |
| | | |

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

| | • | _ | • | - | | | |
|----|--------------------------|----|---------------------|----|-----------------------|----|--------------------------|
| AL | Albania | ES | Spain | LS | Lesotho | SI | Slovenia |
| AM | Armenia | FI | Finland | LT | Lithuania | SK | Slovakia |
| AT | Austria | FR | France | LU | Luxembourg | SN | Senegal |
| ΑU | Australia | GA | Gabon | LV | Latvia | SZ | Swaziland |
| AZ | Azerbaijan | GB | United Kingdom | MC | Monaco | TD | Chad |
| BA | Bosnia and Herzegovina | GE | Georgia | MD | Republic of Moldova | TG | Togo |
| BB | Barbados | GH | Ghana | MG | Madagascar | TJ | Tajikistan |
| BE | Belgium | GN | Guinea | MK | The former Yugoslav | TM | Turkmenistan |
| BF | Burkina Faso | GR | Greece | | Republic of Macedonia | TR | Turkey |
| BG | Bulgaria | HU | Hungary | ML | Mali | TT | Trinidad and Tobago |
| BJ | Benin | IE | Ireland | MN | Mongolia | UA | Ukraine |
| BR | Brazil | IL | Israel | MR | Mauritania | UG | Uganda |
| BY | Belarus | IS | Iceland | MW | Malawi | US | United States of America |
| CA | Canada | IT | Italy | MX | Mexico | UZ | Uzbekistan |
| CF | Central African Republic | JP | Japan | NE | Niger | VN | Viet Nam |
| CG | Congo | KE | Kenya | NL | Netherlands | YU | Yugoslavia |
| CH | Switzerland | KG | Kyrgyzstan | NO | Norway | ZW | Zimbabwe |
| CI | Côte d'Ivoire | KP | Democratic People's | NZ | New Zealand | | |
| CM | Cameroon | | Republic of Korea | PL | Poland | | |
| CN | China | KR | Republic of Korea | PT | Portugal | | |
| CU | Cuba | KZ | Kazakstan | RO | Romania | | |
| CZ | Czech Republic | LC | Saint Lucia | RU | Russian Federation | | |
| DE | Germany | LI | Liechtenstein | SD | Sudan | | |
| DK | Denmark | LK | Sri Lanka | SE | Sweden | | |
| EE | Estonia | LR | Liberia | SG | Singapore | | |
| | | | | | | | |
| | | | | | | | |

INTERATIONAL SEARCH REPORT

Inte Ional Application No PCT/EP 99/00014

| A. CLASSIF IPC 6 | CO7C29/149 CO7D307/08 CO7D307/ | 32 | |
|---------------------|--|--|---|
| | | ation and IPC | |
| According to | International Patent Classification (IPC) or to both national classification | mon and IPC | |
| | cumentation searched (classification system followed by classification | on symbols) | |
| IPC 6 | C07C C07D | | |
| | | the second secon | robod |
| Documentati | ion searcned other than minimum documentation to the extent that s | ncu documents are incinded in the lieids sec | |
| | data bo | co and whore produced search terms used) | |
| Electronic da | ata base consulted during the international search (name of data ba | and. Where practices, bearen terms every | |
| | | | |
| | | | |
| | | | |
| | ENTS CONSIDERED TO BE RELEVANT Citation of document, with indication, where appropriate, of the rel | evant passages | Relevant to claim No. |
| Category * | Citation of document. With Indication. Where appropriate, or the | | |
| Α | WO 86 03189 A (DAVY MCKEE (LONDOI | v)) | 1,8 |
| , , | 5 June 1986 | | |
| i e | see page 5 - page 6; claim 1 | | |
| Α | US 4 032 458 A (S.D. COOLEY, ET | AL.) | 1,8 |
| | 28 June 1977 | | |
| | see column 2; claim 1 | | |
| A | EP 0 190 424 A (CHEMIE LINZ) | | 1 |
| | 13 August 1986 | | |
| | see example 1 | | |
| Α | BE 892 958 A (DAVY MCKEE (OIL & | | 1,7 |
| | CHEMICALS)) 16 August 1982 | | |
| | see page 6 | | |
| | | -/ | |
| | | | |
| | | | |
| X Fur | ther documents are listed in the continuation of box C. | X Patent family members are listed | in annex. |
| ° Special c | ategories of cited documents : | "T" later document published after the inte | emational filing date |
| "A" docum | nent defining the general state of the art which is not idered to be of particular relevance | cited to understand the principle or th | eory underlying the |
| "E" earlier | r document but published on or after the international date | "X" document of particular relevance; the cannot be considered novel or canno | claimed invention t be considered to |
| "L" docum | nent which may throw doubts on priority claim(s) or h is cited to establish the publication date of another | involve an inventive step when the do "Y" document of particular relevance; the | ocument is taken alone |
| citati | on or other special reason (as specified) ment referring to an oral disclosure, use. exhibition or | cannot be considered to involve an in document is combined with one or m | ore other such docu- |
| othe | r means ment published prior to the international filing date but | ments, such combination being obvious in the art. | eus to a person skilled |
| later | than the priority date claimed | "&" document member of the same patent | |
| Date of the | e actual completion of the international search | Date of mailing of the international se | агся героп |
| | 22 June 1999 | 01/07/1999 | |
| Name and | d mailing address of the ISA European Patent Office, P.B. 5818 Patentlaan 2 | Authorized officer | |
| | Nt 2260 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl. | English, R | |

Form PCT/ISA/210 (second sheet) (July 1992)



Int. ional Application No PCT/EP 99/00014

| | tion) DOCUMENTS CONSIDERED TO BE RELEVANT Citation of document, with indication where appropriate, of the relevant passages | Relevant to claim No. |
|-----------|--|-----------------------|
| ategory * | Citation of document, with indication, where appropriate, or the relevant passages | Tierevant to Gain No. |
| 1 | US 4 652 685 A (J.N. CAWSE, ET AL.) 24 March 1987 see column 2 - column 3; examples | 1,7 |
| | US 2 251 895 A (W. REPPE, ET AL.) 5 August 1941 see the whole document | 1 |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |

INTE ATIONAL SEARCH REPORT

information on patent family members

Inte onal Application No PCT/EP 99/00014

| Patent document cited in search report | Publication date | Patent family member(s) | Publication date |
|--|------------------|--|--|
| WO 8603189 A | 05-06-1986 | BR 8507068 A CA 1249837 A EP 0204730 A JP 6055684 B US 4751334 A JP 62501702 T | 14-07-1987 07-02-1989 17-12-1986 27-07-1994 14-06-1988 09-07-1987 |
| US 4032458 A | 28-06-1977 | NONE | |
| EP 0190424 A | 13-08-1986 | DE 3503485 A AT 57523 T CS 8600708 A JP 61180742 A | 07-08-1986 15-11-1990 13-10-1989 13-08-1986 |
| BE 892958 A | 16-08-1982 | AU 560590 B AU 8336582 A BR 8207962 A CA 1229096 A FI 831848 A WO 8203854 A GB 2116552 A,B JP 4057655 B JP 58500993 T NL 191438 B NL 8220121 T SE 452154 B SE 8303027 A ZA 8202718 A | 09-04-1987 07-12-1982 04-10-1983 10-11-1987 24-05-1983 11-11-1982 28-09-1983 14-09-1992 23-06-1983 01-03-1995 01-07-1983 16-11-1987 30-05-1983 30-03-1983 |
| US 4652685 A | 24-03-1987 | EP 0222398 A JP 62155231 A | 20-05-1987 10-07-1987 |
| US 2251895 A | 05-08-1941 | NONE | · |

THIS PAGE BLANK (USPTO)